The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A Pb-free solder consisting essentially of about 3.5 to about 7.7 weight % Ag, about 1.0 to about 4.0 weight % Cu and the balance essentially Sn.

2. The Pb-free solder of Claim 1 further including an additional alloy component in an amount effective to lower the solder melting temperature range.

3. The Pb-free solder of Claim 2 including Bi in an amount not exceeding about 10 weight %.

4. The Pb-free solder of Claim 1 further including at least one additional alloy component selected from the group consisting essentially of Si, Sb, Zn, Mg, Ca, a rare earth element, and misch metal in a collective amount not exceeding about 1 weight %.

~~5. The solder of Claim 1 further including Pb in an amount not exceeding about 10 weight %.~~

6. A Pb-free solder including a ternary eutectic composition consisting essentially of about 93.6 weight % Sn-about 4.7 weight % Ag-about 1.7 weight % Cu having a eutectic melting temperature of about 217°C and variants of said ternary composition wherein the relative concentrations of Sn, Ag, and Cu deviate from said ternary eutectic composition to provide a controlled melting temperature range not exceeding 15°C above ~~relative to~~ said eutectic melting temperature and at least two intermetallic compounds dispersed in a beta Sn matrix wherein one intermetallic compound includes Cu and Sn and another intermetallic compound includes Ag and Sn.

7. The Pb-free solder of Claim 6 wherein Sn, Ag, and Cu are varied from the ternary eutectic composition to provide a solder melting temperature range that extends no more than 15°C above said eutectic melting temperature.

8. The Pb-free solder of Claim 6 further including Bi in an amount not exceeding about 10 weight %.

9. The Pb-free solder of Claim 6 further including at least one alloy component selected form the group consisting essentially of Si, Sb, Zn, Mg, Ca, a rare earth element, and misch metal in a collective amount not exceeding about 1 weight %.

10. The solder of Claim 6 further including Pb in an amount not exceeding about 10 weight %.

11. A Pb-free solder comprising a ternary eutectic composition consisting essentially of about 93.6 weight % Sn-about 4.7 weight % Ag-about 1.7 weight % Cu having a melting temperature of about 217°C.

12. A solder joint comprising a Pb-free solder including a ternary eutectic composition consisting essentially of about 93.6 weight % Sn-about 4.7 weight % Ag-about 1.7 weight % Cu having a eutectic melting temperature of about 217°C and variants of said ternary composition wherein the relative concentrations of Sn, Ag, and Cu deviate from said ternary eutectic composition to provide a controlled melting temperature range not exceeding 15°C above said eutectic melting temperature, said solder joint having a microstructure comprising beta Sn phase matrix and at least two intermetallic compounds, one intermetallic compound including Cu and

Sn and another intermetallic compound including Ag and Sn, distributed uniformly in the beta Sn matrix phase.

~~13.~~ The solder joint of Claim 12 wherein Sn, Ag, and Cu are varied from the ternary eutectic composition to provide a solder melting temperature range that extends no more than 15°C above said eutectic melting temperature.

~~14.~~ 10 The solder joint of Claim ~~12~~ 9 wherein the solder includes an alloy component in an amount effective to lower the solder melting temperature range.

~~15.~~ 11 The solder joint of Claim ~~12~~ 9 wherein the solder includes Bi in an amount not exceeding about 10 weight %.

~~16.~~ 12 The solder joint of Claim ~~12~~ 9 wherein the solder includes at least one alloy component selected from the group consisting essentially of Si, Sb, Zn, Mg, Ca, a rare earth element, and misch metal in a collective amount not exceeding about 1 weight %.

17. The solder joint of Claim 12 wherein the solder includes Pb in an amount not exceeding about 10 weight %.

18. A solder joint comprising a Pb-free solder consisting essentially of about 3.5 to about 7.7 weight % Ag, about 1.0 to about 4.0 weight % Cu and the balance essentially Sn, said solder joint having a microstructure comprising beta Sn phase matrix and at least two intermetallic compounds, one intermetallic compound including Cu and Sn and another intermetallic compound including Ag and Sn distributed uniformly in the beta Sn matrix phase.

19. A solder joint comprising a Pb-free solder ~~comprising a~~ ternary ~~eutectic~~ composition consisting ~~essentially~~ of about 4.7 weight % Ag, about 1.7 weight % Cu and the balance Sn.

20. In a soldering process involving solidifying a molten solder, the improvement comprising solidifying a molten Pb-free solder comprising a ternary eutectic composition consisting essentially of about 93.6 weight % Sn-about 4.7 weight % Ag-about 1.7 weight % Cu having a eutectic melting temperature of about 217°C and variants of said ternary composition wherein the relative concentrations of Sn, Ag, and Cu deviate from said ternary eutectic composition to provide a controlled melting temperature range, ~~relative to~~ not exceeding 15°C above said eutectic melting temperature and upon solidification at least two intermetallic compounds, one intermetallic compound including Cu and Sn and the other intermetallic compound including Ag and Sn dispersed in a beta Sn phase matrix.

21. The process of Claim 20 wherein the solder melting temperature is controlled so as not to exceed about 15°C above the eutectic melting temperature.

22. In a soldering process involving solidifying a molten solder, the improvement comprising solidifying a Pb-free solder consisting essentially of about 3.5 to about 7.7 weight % Ag, about 1.0 to about 4.0 weight % Cu and the balance essentially Sn.

23. In a soldering ~~process~~ involving solidifying a molten solder, the ~~improvement~~ comprising solidifying a molten Pb-free solder consisting ~~essentially~~ of about

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D ~~4.7 weight % Ag, about 1.7 weight % Cu and the balance essentially Sn.~~

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